HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Palmer Ponds Summer Steelhead Program
Species or Hatchery Stock:	Steelhead (*Oncorhynchus mykiss)* Green River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Duwamish/Green River Puget Sound
Date Submitted:	March 17, 2003
Date Last Updated:	March 20, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Palmer Ponds "Summer" Steelhead Program

1.2) Species and population (or stock) under propagation, and ESA status.

Green River Steelhead (*Onchorynchus mykiss*) - not listed

1.3) Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The Muckleshoot Indians share co-management authority of steelhead stocks in the Green River system.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

The summer run steelhead program is currently funded by donations from the Muckleshoot Indian Tribe. One person is staffed full time at Palmer Ponds. Production costs for the summer run program are approximately $7500 annually.

1.5) Location(s) of hatchery and associated facilities.

Palmer Ponds:	Unnamed stream (09.0147) at RM 0.2, tributary to the Green River (09.0001) at RM 56.1.
Soos Creek Hatchery:	Big Soos Creek (09.0072) at RM 1, tributary to the Green River (09.0001) at RM 33.5.

1.6) Type of program.

Isolated harvest

1.7) Purpose (Goal) of program.

Augmentation.

The goal of this program is to provide adult fish for sport and tribal harvest opportunity.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Release steelhead as smolts with expected brief freshwater residence.

2. Time of release not to coincide with out-migration of listed fish.

3. Only appropriate stock will be propagated.

4. Mark all reared fish.

5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g.NPDES criteria.

1.9) List of program Performance Standards .

See section 1.10.

1.10) List of program Performance Indicators , designated by "benefits" and "risks."

Performance Standards and Indicators for Puget Sound **Isolated Harvest** Steelhead programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch
Meet hatchery production goals	Number of juvenile fish released - 5**0,000 from Palmer; 30,000 from Soos Cr (see section 1.11.2)**	Future Brood Document (FBD) and hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records
Minimize interactions with listed fish through proper broodstock management and mass marking. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - **goal: 80**	Rack counts
	Stray Rates	Spawning guidelines
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - **September through November**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - **see section 8.3**	
	Total number of wild adults passed upstream - **only hatchery steelhead are broodstocked, wilds' released**	

Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish - **May/May**	FBD and historic natural outmigration times
	Size and time of release - **5 fpp/May release**	FBD and hatchery records
	Hatchery stray rates	Hatchery records (marked vs unmarked)
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	
Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy
	Fish pathologists will diagnose fish health problems and minimize their impact	Fish Health Monitoring Records
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	

Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

80 adults.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Palmer Ponds (Green River; 09.0001) *Soos Creek (09.0072)	50,000 30,000

*- Release from Soos Creek Hatchery began in May, 2002.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Recent 12 year average, range, and goal: (Source is WDFW Fish Management data)

Smolt-to-adult survival: Average 1.86%; Range .36% to 7.84%. Goal 3%
Adult production level: Average 947; Range 189 to 1830 Goal 3000
Hatchery escapement: Approximately 50 in year 2000. Goal 80.
Natural escapement: Approximately 3% of annual adult return. Goal <5%.

1.13) Date program started (years in operation), or is expected to start.

1970

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Duwamish/Green River (09.0001)

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

Program goals supporting tribal and sport fisheries cannot be attained without hatchery augmentation.

<u>SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS</u>.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

None

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) <u>Description of ESA-listed salmonid population(s) affected by the program.</u>

- Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.

- Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Duwamish/Green River/Summer-Fall Chinook

The mean age ratio of chinook carcasses sampled on Green River spawning grounds in return years 1988 through 1997 was 5.5% age 2, 19.1% age 3, 64.4% age 4, 10.9% age 5 and 0.1% age 6. The adult sex ratio of sampled carcasses in 1999 was 52% male and 48% female. At age 3, 4, 5 and 6, adults average 60 to 80 cm., 80 to 95 cm., 85 to 100 cm. and 95 to 105 cm., respectively.

Most naturally-spawned Green River chinook migrate to salt water after spending only a few months in freshwater. Arrival of both hatchery and naturally-produced smolts in the estuary peaks in May, and after a few weeks, most begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean. Sexually mature fish begin arriving back at the river mouth as early as July. The upstream migration peaks in late August to mid-September. Spawning begins in early September, peaks in early October, and is generally complete by early November.

Adults spawn in the mainstem Green River from about RM 25.4 in Kent to the City of Tacoma diversion dam at RM 61. Approximately 70% of natural spawning occurs upriver from the mouth of Soos Creek (RM 33.5). Tributary spawning occurs in the lower 4 miles of both Soos and Newaukum Creeks.

2.2.2) <u>Status of ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to critical and viable population thresholds (*see definitions in Attachment 1").*

Critical and viable population thresholds under ESA have not been determined, however, the SASSI report (WDFW) determined this population (Duwamish/Green Summer/Fall Chinook) to be "healthy".

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

On average (return years 1987-98), each Green River natural spawner produces 2.33 adults returning to Washington waters. (WDFW Chinook Run-reconstruction Tables)

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Escapements have exceeded the 5,800 fish goal in 9 of the past 12 years (1988-99), with a range of 2,476 to 11, 512. The 12-year average escapement is 7,598. (WDFW RR Tables)

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The ratio of Soos Creek hatchery-origin adults to mainstem Green River natural spawners averaged 33.4% in 7 years between 1989 and 1997 (WDFW coded-wire tag data). Small sample sizes (<4%) in 5 of these years, and the limited area sampled (river mile 33.8 to 41.4 only), make these data less than reliable when applied to the entire river.

The ratio of Soos Creek hatchery-origin adults to Newaukum Creek natural spawners averaged 23.3% in 9 years between 1989 and 1997 (WDFW coded-wire tag data) Sample rates averaged 30% per year.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

Trapping of adult summer steelhead occurs at Palmer Ponds and Soos Creek between September and November. Chinook may enter the trap at Palmer, but is not very likely due to the small size and declination of the outlet creek. Any listed fish that enter the trap will be returned to the river to spawn. There may be a potential for listed chinook to be impacted at Soos Creek due to steelhead collection, but care will be taken to return any non-marked fish back to the river unharmed.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Unknown

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Unknown (see "take" table)

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

None.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

None

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Returning summer steelhead adults provide for tribal subsistence and sport fisheries from June through December each year. Total annual harvest averaged 920 fish (range 184 to 1779) from 1988-1999. Harvest rate is estimated at 97%. The incidental take of listed Green River chinook during summer steelhead fisheries is estimated at less than 20 per year.

3.4) Relationship to habitat protection and recovery strategies.

The comanagers resource management plans for artificial production in Puget Sound are expected to be one component of a recovery plan for Puget Sound chinook under development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

3.5) Ecological interactions.

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program. Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

Nutrient Enhancement
Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

Predation Freshwater Environment
Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). The site specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

<u>Environmental Characteristics.</u> Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.

<u>Relative Body Size.</u> The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon

originating from natural production have been monitored in numerous watersheds throughout Puget Sound, including the Skagit River , Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

Table 3.5.1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey can be no greater than 1/3 the length of the predator, are provided in the final row of the table. (NS: not sampled.)

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Stillaguamish [2] 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar [3] 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green [4] 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup [5] 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness [6] 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

[3] Data are from Seiler et al. (2003).

[4] Data are from Seiler et. (2002).

[5] Data are from Samarin and Sebastian (2002).

[6] Data are from Marlowe et al. (2001).

Date of Release. The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of naturally produced juvenile chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River. Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

Table 3.5.2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear [2] 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar [2] 1999-2000	0.76	0.76	.0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green [3] 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from Seiler et al. (2003).

[3] Data are from Seiler et. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program are commingled with the listed species. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles day. Steelhead smolts released onstation may travel even more rapidly   migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to offstation release sites, particularly release sites located outside of the watershed in which the fish have been reared, may slow migrations speeds (Table 3.5.3).

Table 3.5.3. Summary of travel speeds for steelhead smolts for several types of release strategies.

Location	Release Type	Migration Speed (river miles per day)	Source
Cowlitz River	Smolts, onstation	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et al. (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et al. (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et al. (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

Predation   Marine Environment

WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984).

2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington do not substantiate any indication of significant predation upon juvenile salmonids (Simenstad and Kinney 1978).

3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance.

Competition

WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that migrant fish will likely be present for too short a period to compete with resident salmonids.
2) NMFS (2002) noted that ..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates.
3) Flagg et al. (2000) concluded, By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids. Flagg et al (2000) also stated It is

unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment.
4) Fresh (1997) noted that   Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Soos Creek Hatchery is supplied by surface water from Soos Creek. Water is withdrawn via 4 pumps at the hatchery site. Pumps produce 13,500 gallons per minute (gpm). In addition, a small spring water supply (50 gpm) can be utilized in the incubation building.

Palmer Ponds water supply is spring water ranging from 2-15 cfs, which is gravity fed. It is considered high quality and cold, with temperatures between 46 and 52 degrees.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The intakes shall be operated with mesh openings not exceeding 1/8th inch and with approach velocities less than .4 feet / second. The screens at the Soos Creek facility were not in compliance due to winter damage but are scheduled for replacement in the near future. Hatchery effluent shall meet or exceed NPDES permit standards for discharge of pond cleaning waste or pond drawdown.

Palmer Ponds is a spring water source that contains no fish species above the intake structures.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock is collected in the outlet to the rearing pond at Palmer. There is a concrete raceway where the fish are captured. At Soos Creek, there is a weir with a V-trap ladder where steelhead enter into a large in-stream holding pond.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Adults trapped at Palmer remain at Palmer. If broodstock are trapped at Soos Creek, they are hauled to holding ponds in various sized tanker trucks equipped with oxygen tanks, airstones and recirculating pumps.

5.3) Broodstock holding and spawning facilities.

After trapping, broodstock are held in 20 foot diameter round ponds at Palmer. Fish are spawned at pondside. At Soos Creek, fish will be held in the holding pond and spawned at pondside (see Soos Creek coho HGMP for detail).

5.4) Incubation facilities.

All eggs are incubated at Soos Creek Hatchery (see Soos Creek coho HGMP).

5.5) Rearing facilities.

Portion of the steelhead destined for Palmer Ponds are initially reared at Soos Creek Hatchery. They are transferred to Palmer between 80-100 fish per pound (fpp).

5.6) Acclimation/release facilities.

Fish are acclimated and released from Palmer Ponds and Soos Creek hatchery.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

None known.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

The Soos Creek Hatchery is equipped with a backup generator and adequate fuel supply in the event of a power outage. Two persons are on rotating standby status year around in the event of a problem. An upgraded alarm system is designed to detect changes in flow and power status. The risk of disease transmission shall be limited by using effective theraputents, as prescribed and in a timely manner.

Palmer Ponds Palmer Ponds is on gravity flow and has never sustained fish losses due to high water.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Adults returning to the Palmer Ponds and Soos Creek hatchery traps.

6.2) Supporting information.

6.2.1) History.

The Skamania stock was founded in 1963 and has since been transplanted to various hatcheries throughout Washington and several other states. Selection for early spawning time was necessary to obtain one-year smolts. In recent years, eggs for the Green River program have come from the Reiter Ponds on the Skykomish River. This broodstock is largely Skamania origin, but has also included some Skykomish origin fish. Efforts to trap returning adults began at Keta Creek (Muckleshoot Tribe) and Palmer Ponds in 2000, with the goal of developing a local summer steelhead broodstock form the Skamania/Skykomish stock. Currently adults are trapped as Palmer Ponds and Soos Creek.

6.2.2) Annual size.

80 adults (40 males and 40 females), assuming fecundity of 3000 eggs per female. Only adipose-fin clipped fish will be used for broodstock.

6.2.3) Past and proposed level of natural fish in broodstock.

All summer steelhead currently used for hatchery broodstock are of hatchery origin (adipose-fin clipped).

6.2.4) Genetic or ecological differences.

Historically, the Green River did not contain wild summer steelhead. Since the start of the hatchery program, naturally produced summer steelhead have been present in small numbers in the Green River as a result of some limited spawning of unharvested fish. No genotypic, phenotypic, or behavioral differences have been noted between these fish and the hatchery stock.

6.2.5) Reasons for choosing.

Originally early maturing fish were selected, at Skamania, in order to obtain one year smolts.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

NA

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults

7.2) Collection or sampling design.

Summer steelhead are trapped at Palner Ponds and Soos Creek between September and November with traps associated with those tributaries or rearing ponds.

7.3) Identity.

All steelhead used for broodstock are of hatchery origin and 100% identified with an adipose-fin clip.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

80. The year 2000 was the first year that summer run steelhead were trapped and used for broodstock on the Green River system.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999	1	1		3,300	
2000	4	3		13,000	
2001	25	17		90,000	

Data source: Palmer ponds hatchery records

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Surplus fish can be recycled for additional sport fishing opportunity if not needed for broodstock.

7.6) Fish transportation and holding methods.

Adults are transported in various sized tanker trucks equipped with oxygen tanks, air stones and recirculating pumps.

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols, as defined in the Co-Manager Fish Health Manual (WDFW 1996) are adherred to.

7.8) Disposition of carcasses.

Spawned carcasses are utilized for nutrient enhancement or disposed of.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Trapping of adult summer steelhead occurs at Palmer Ponds and Soos Creek Hatchery between September and November. Chinook may enter the trap at Palmer, but it is not very likely due to the small size and declination of the outlet creek. Any listed fish that enter the trap will be returned to the river to spawn. There may be a potential for listed chinook to be impacted at Soos Creek due to steelhead collection, but care will be taken to return any non-marked fish back to the

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Females are chosen based on ripeness. The pond is sorted once a week from the third week in January until spawning is complete.

8.2) Males.

Spawning is based on a 1:1 ratio with the use of a backup male to insure fertilization. Jacks are used, if available, up to 1% of broodstock total.

8.3) Fertilization.

Matings are 1:1 with the use of a backup male. Eggs are water hardened and disinfected in a 100 parts per million (ppm) iodophor solution.

8.4) Cryopreserved gametes.

NA

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

NA

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. egg to smolt survival) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

2000 was the first year of broodstock collection. 80,000 eggs were collected and 85% survival to eye-up was achieved. In past years, 120,000 eggs were transferred to produce 80,000 smolts.

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus fish could be planted into local lakes without an outlet to provide fishing opportunity, although this has not occurred at this facility.

9.1.3) Loading densities applied during incubation.

Steelhead eggs average 2800 to the pound. Incubation occurs in shallow troughs receiving 8-10 gpm. Loadings are 20,000 per shallow trough. All eggs are incubated at Soos Creek Hatchery.

9.1.4) Incubation conditions.

Temperature is monitored daily and incubation systems are checked daily by hatchery personnel.

9.1.5) Ponding.

Fish are initially fed in the shallow trough incubators where they are incubated. Fish are given feed at 95% button up. Fish are force ponded into larger intermediate or standard raceways when they are between 500-1000 fish per pound (fpp).

9.1.6) Fish health maintenance and monitoring.

Eggs receive daily formalin treatments until hatch out. Eggs are shocked and picked at 600 Temperature Units (TU's).

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

NA

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Fry to smolt survival rates have ranged between 20.7 and 91.9%, with an average of 65.1%. Bird and otter predation have been the most significant contributors to loss.

9.2.2) Density and loading criteria (goals and actual levels).

Fish are reared in large earthen ponds at Palmer and rearing conditions do not fit into the same criteria as in raceways, space is not a limiting factor. While fish are reared at Soos Creek, loading goals conform to guidelines set out in Fish Hatchery Management (Piper, 1982).

9.2.3) Fish rearing conditions

Palmer Ponds water supply is spring water ranging from 2-15 cfs, which is gravity fed. It is considered high quality and cold, with temperatures between 46 and 52 degrees. All ponds at Soos Creek receive ambient surface water from the creek. Incoming oxygen levels are saturated, but are not normally monitored. Due to heavy silt loads the ponds are vacuumed frequently (weekly or as-needed).

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Not available.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Fish are fed a variety of dry pellet and starter mash formulations depending on life stage. Fish are fed on an aggressive schedule in order to produce a 1 year smolt between five and eight to the pound. Feed rates vary widely depending on time of the year and size of the fish.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Specialist perform routine checks on fish health.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

NA

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

NA

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

NA

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	50,000 *30,000	5 5	May May	Palmer Pond Soos Cr.

*- Releases from Soos Creek Hatchery began in May, 2002.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Green River
Release point: Palmer Ponds (Green River, 09.0001) at RM 56.1 and on Soos Creek at RM 1, tributary to the Green River at RM 33.5.
Major watershed: Duwamish/Green River
Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							83,582	6
1996							100,125	6
1997							52,509	7
1998							61,396	9
1999							46,784	8
2000							65,273	7
2001							65,860	6
Average							67,933	7

Data source: Palmer ponds hatchery records (release numbers are for Palmer ponds only (WDFW)).

10.4) Actual dates of release and description of release protocols.

Typically steelhead smolts are released in early to mid May. Releases are volitional for the first several weeks, then forced at the end.

10.5) Fish transportation procedures, if applicable.

The smolts are released on site and therefore do not need any transportation.

10.6) Acclimation procedures.

All steelhead released at Palmer Ponds are acclimated on spring water over the entire rearing period. Prior to the release at Soos Creek, fish are acclimated on surface water.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All steelhead are 100% identified with an adipose-fin clip (mass mark).

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Surplus fish have not been an issue because of otter and bird predation.

10.9) Fish health certification procedures applied pre-release.

Routine fish health inspection by the Area Fish Health Specialist prior to release.

10.10) Emergency release procedures in response to flooding or water system failure.

Depending upon circumstances, release fish with either the highest probability of surviving to adulthood or the fish with the highest probability of sustaining catastrophic loss if held at the hatchery.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

To minimize the risk of residualization and impact upon natural fish, hatchery yearlings are released in May as smolts and only in the Green River watershed. All fish released are mass marked.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of Performance Indicators presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each Performance Indicator identified for the program.

The comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.

2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:

- a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;
- b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;
- c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;
- d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:

- a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?
- b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?
- c) What is the rate of residualism of steelhead in Puget Sound rivers?

Funding needs have not yet been quanitifed, but would likely be met through a combination of federal and state sources.

4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated assessment of hatchery and wild populations.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

See Section 11.1.1.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures will be developed in conjunction with the monitoring and evaluation plans.

SECTION 12. RESEARCH

12.1) Objective or purpose.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached take table (Table 1).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook ESU/Population: Puget Sound Activity: Hatchery Operations				
Location of hatchery activity: Palmer Ponds/Soos Cr. Dates of activity: December-May Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)	Unknown	Unknown		
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*